## SCOPE

Furnish (2) ABS Model XFP201G-CB2.1-PE120/8G submersible non-clog wastewater pumps with a maximum of 875 RPM represented by Flow-Technics, Inc. Frankfort, IL 815-277-2600.The pumps shall be supplied with a mating cast iron eight inch discharge connection and be capable of delivering 1000 U.S. GPM at a total dynamic head of 30 feet. An additional point on the same curve shall be 2000 U.S. GPM at a total dynamic head of 21 feet. Shut off head shall be 39 feet (minimum). The Premium Efficiency Motor shall be an integral part of the pump unit. The motor shall be 16.1HP connected for operation on a 460 volt, 3 phase, 60 hertz electrical supply service. Pumps intended for wet pit installation shall be supplied with a cast iron single guide rail system with an integrated eight inch discharge elbow. The working load rating of the lifting system shall be a minimum of 50% greater than the pump weight. Each pump motor shall be equipped with 49 feet of power and control cable sized in accordance with NEC and CSA standards

## PLIMP DESIGN

The heavy duty submersible wastewater pump(s) shall be capable of handling raw unscreened sewage, storm water, and other similar solids—laden fluids without clogging. The pump shall be driven by a high efficiency motor, providing the highest levels of operational reliability and energy efficiency.

## GUIDE RAIL BASE ASSEMBLY (wet pit installation)

There shall be no need for personnel to enter the wet well to remove or reinstall the pump(s). In a wet pit installation, the discharge base & elbow assembly shall be permanently installed in the wet well and connected to the discharge piping. In order to prevent binding or separation of the pump from the guide rail system, the pump(s) shall connect to the guide rail base automatically and firmly, guided by one 2 inch guide pipe extending from the base elbow to the top of the station. Systems using guide cable in lieu of rigid guide bars or pipes shall not be considered acceptable. The sliding guide bracket shall be a separate part of the pumping unit, capable of being attached to standard 8 inch ANSI class 125 or metric DN200 pump flanges, so that the pump mounting is non proprietary, and any pump with a standard discharge flange can be mounted on the base assembly. Base or bracket assemblies with proprietary or non standard flange dimensions shall not be considered acceptable.

A field replaceable Nitrile (Buna—N) rubber profile gasket or o—ring shall accomplish positive sealing of the pump flange/guide rail bracket to the discharge elbow. Base assemblies which rely solely on metal to metal contact between the pump flange and discharge base elbow as a means of sealing are inherently leak prone, and shall not be considered equal. No portion of the pump shall bear directly on the floor of the sump. The guide rail system shall be available in an optional non—sparking version, approved by Factory Mutual for use in NEC Class 1, Division 1, Group C&D hazardous locations.

In a dry pit installation, the pump shall be secured to a steel support stand of suitable strength to support the weight of the pump and resist any expected torsion, bending, or vibration forces. The pump shall be suitable for either vertical or horizontal dry pit installation without requiring any internal modifications.

## PUMP CONSTRUCTION

Major pump components shall be of gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B) with smooth surfaces devoid of porosity or other irregularities. All exposed fasteners shall be stainless steel 1.4401 (AISI type 316) construction. All metal surfaces coming into contact with the pumped media (other than the stainless steel components) shall be protected by a factory applied spray coating of zinc phosphate primer followed by a high solids two part epoxy paint finish on the exterior of the pump. The pump shall be equipped with an open lifting hoop suitable for attachment of standard chain fittings, or for hooking from the wet well surface. The hoop shall be stainless steel 1.4401 (AISI 316), and shall be rated to lift a minimum of four times the pump weight.

Sealing design for the pump/motor assembly shall incorporate machined surfaces fitted with Nitrile (Buna-N) rubber O-rings. Sealing will be the result of controlled compression of rubber O-rings in two planes of the sealing interface. Housing interfaces shall meet with metal to metal contact between machined surfaces, and sealing shall be accomplished without requiring a specific torque on the securing fasteners. Rectangular cross sectioned gaskets requiring specific torque limits to achieve compression shall not be considered equal. No secondary sealing compounds shall be required or used.

Impeller: The ABS ContraBlock impeller shall be of gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B). The impeller shall be of the semi-open, non-clogging, two vane design, meeting the <u>Ten State Standards</u> requirement for minimum solids passage size of 3 inches. The impeller shall be capable of passing a minimum of 4.9 inch diameter spherical solids as are commonly found in waste water. The impeller shall have a slip fit onto the motor shaft and drive key, and shall be securely fastened to the shaft by a stainless steel bolt which is mechanically prevented from loosening by a positively engaged ratcheting washer assembly. The head of the impeller bolt shall be effectively recessed within the impeller bore to prevent disruption of the flow stream and loss of hydraulic efficiency. The impeller shall be dynamically balanced to the ISO 10816 standard to provide smooth vibration free operation. Impeller designs which do not meet the <u>Ten State Standards</u> requirement for 3 inch solids passage size, those that rely on retractable impeller designs to pass 3 inch solids, or those that rely on fins or pins protruding into the suction path to assist in the handling of fibrous material shall not be considered equal.

Self Cleaning Wear Plate: The ABS ContraBlock Plus wear plate shall be constructed from gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B). The wear plate shall be designed with an inlet incorporating strategically placed cutting grooves and an outward spiral V-shaped groove on the side facing the impeller, to shred and force stringy solids outward from the impeller and through the pump discharge. The wear plate shall be mounted to the volute with four stainless steel securing screws and four stainless steel adjusting screws to permit close tolerance adjustment between the wear plate and impeller for maximum pump efficiency. Adjustment to allow for wear and restore peak pumping performance shall be accomplished using standard tools, and without requiring disassembly of the pump. The use of fixed or non-adjustable wear plates or rings, or systems that require disassembly of the pump or shimming of the impeller to facilitate adjustment shall not be considered equal. The suction flange shall be integrated into the wear plate and its bolt holes shall be drilled and threaded to accept standard 8 inch ANSI class 125 flanged fittings.

Pump Volute: The pump volute shall be single piece gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B) non-concentric design with centerline discharge. Passages shall be smooth and large enough to pass any solids which may enter the impeller. Discharge size shall be as specified on the pump performance curve. The discharge flange design shall permit attachment to standard ANSI or metric flanges/appurtenances. The discharge flange shall be slotted to accept both 8 inch ANSI class 125 and metric DN200 (PN 10) metric flanged fittings. Proprietary or non standard flange dimensions shall not be considered acceptable. The minimum working pressure of the volute and pump assembly shall be 10 bar (145 psi).

# MOTOR The high off

VA FORM 08-623

The high efficiency motor shall be designed in accordance with the efficiency standards IEC 60034-30, and NEMA Premium\*. Motor rating tests shall be conducted in accordance with IEC 60034-2-1 requirements and shall be certified accurate and correct by a third party certifying agency. A certificate shall be available upon request.

\* IEC 60034—30 and NEMA Premium efficiency do not apply to 8 pole motors, only 2, 4, and 6 pole motors. The PE motors are designed to meet expected IE3 efficiency levels in future revisions of the IEC 60034—30 standard.

The motor shall be housed in a water tight gray cast iron, EN-GJL-250 (ASTM A-48, Class 35B) enclosure capable of continuous submerged operation underwater to a depth of 20 meters (65 feet), and shall have an IP68 protection rating. The motor shall be of the squirrel-cage induction design, NEMA type B. The copper stator windings shall be insulated with moisture resistant Class H insulation materials, rated for 180oC (356oF). The stator shall be press fitted into the stator housing. The use of bolts, pins or other fastening devices requiring penetration of the stator housing is unacceptable. The rotor bars and short circuit rings shall be made of cast aluminum.

The motor shall be designed for continuous duty. The maximum continuous temperature of the pumped liquid shall be  $40 \circ C$  ( $104 \circ F$ ), and intermittently up to  $50 \circ C$  ( $122 \circ F$ ). The motor shall be capable of handling up to 15 evenly spaced starts per hour without overheating. The service factor (as defined by the NEMA MG1 standard) shall be 1.3. The motor shall have a voltage tolerance of +/- 10% from nominal, and a phase to phase voltage imbalance tolerance of 1%. The motor shall be FM and CSA approved for use in NEC Class I, Division I, Groups C & D hazardous locations. The surface temperature rating shall be T3C. The motor shall meet the requirements of NEMA MG1 Part 30 and 31 for operation on PWM type Variable Frequency Drives.

The motor shall be capable of operating, completely submerged, partially submerged, or unsubmerged. For submerged (wet pit) applications, the motor shall be self cooling via the process fluid surrounding the motor. For unsubmerged (dry pit) applications, an optional integrated glycol based cooling system shall be utilized to enhance heat transfer, and allow the motor to operate at full rated power continuously without the need for de-rating or reduced duty cycle.

Optional Cooling System: The factory installed closed loop cooling system shall be adequately designed to allow the motor to run continuously under full load while in an unsubmerged or minimally submerged condition. A cooling jacket shall surround the stator housing, and an environmentally safe non—toxic propylene glycol solution shall be circulated through the jacket by a circulating impeller attached to the main motor shaft. The coolant shall be pumped through an integrated heat exchanger in the base of the motor whenever the motor is running, allowing excess heat to be transferred to the process liquid. Cooling systems that circulate the pumped medium through the cooling jacket, or those that use a toxic cooling liquid shall not be acceptable. The use of external heat exchangers, fans, or the supply of supplemental cooling liquid shall not be required.

Thermal Protection: Each phase of the motor shall contain a normally closed bi—metallic temperature monitor switch imbedded in the motor windings. These thermal switches shall be connected in series and set to open at 1400C + / - 50C (2840F). They shall be connected to the control panel to provide a high stator temperature shutdown signal, and are used in conjunction with external motor overload protection. As an option, an RTD (PT100) type temperature measuring device shall be available for the motor winding to provide actual temperature measurement of the winding. When the RTD option is supplied for the motor winding, bi—metallic switches shall also be supplied in the winding. The bi—metallic system must be connected to the control to provide positive shutdown of the motor in the event of an overheat condition. This is required in order to conform to FM and CSA rules for explosion proof equipment.

Mechanical Seals: Each pump shall be equipped with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The mechanical seals shall be of non proprietary design, and shall be manufactured by a major independent manufacturer specializing in the design and manufacture of mechanical seals. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary industrial duty silicon—carbide seal ring and one rotating industrial duty silicon—carbide seal ring. The stationary ring of the primary seal shall be installed in a seal holding plate of gray cast iron EN-GJL-250 (ASTM A-48, Class 35B). The seal holding plate shall be equipped with swirl disruption ribs to prevent abrasive material from prematurely wearing the seal plate. The upper, secondary seal unit, located between the lubricant chamber and motor housing, shall contain one stationary industrial duty silicon—carbide seal ring, and one rotating one rotating industrial duty silicon—carbide seal ring. Each seal interface shall be held in contact by its own spring system. The seals shall not require routine maintenance, or adjustment, and shall not be dependent on the direction of rotation for proper sealing. Each pump shall be provided with a lubricant chamber for the shaft sealing system which shall provide superior heat transfer and maximum seal cooling. The lubricant chamber shall be designed to prevent overfilling, and to provide lubricant expansion capacity. The drain and inspection plug shall have a positive anti—leak seal, and shall be easily accessible from the outside of the pump. The seal system shall not rely upon the pumped media for lubrication and shall not be damaged when the pump is run dry. Lubricant in the chamber shall be environmentally safe non toxic material.

The following seal types shall not be considered equal: Seals of proprietary design, or seals manufactured by other than major independent seal manufacturing companies. Seals requiring set screws, pins, or other mechanical locking devices to hold the seal in place, conventional double mechanical seals containing either a common single or double spring acting between the upper and lower seal faces, any system requiring a pressure differential to seat the seal and ensure sealing.

## Mechanical Seal Protection System:

The primary mechanical seal shall be protected from interference by particles in the waste water, including fibrous materials, by an active Seal Protection System integrated into the impeller. The back side of the impeller shall be equipped with a sinusoidal cutting ring, forming a close clearance cutting system with the lower submersible motor housing or seal plate. This sinusoidal cutting ring shall spin with the pump impeller providing a minimum of 75 shearing actions per pump revolution. Large particles or fibrous material which attempt to lodge behind the impeller, or wrap around the mechanical seal shall be effectively sheared by the active cutting system into particles small enough the prevent interference with the mechanical seal. The Seal Protection System shall operate whenever the pump operates, and shall not require adjustment or maintenance in order to function. Submersible pump designs which do not incorporate an active cutting system to protect the primary mechanical seal shall not be considered acceptable for wastewater service.

Seal Failure Early Warning System: The integrity of the mechanical seal system shall be continuously monitored during pump operation and standby time. An electrical probe shall be provided in a sensing chamber positioned above the mechanical seals for detecting the presence of water contamination within the chamber. The sensing chamber shall be air filled, and shall have a drain / inspection plug with a positive anti-leak seal which is easily accessible from the outside of the pump. A solid-state relay mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe, continuously monitoring the conductivity of the liquid in the sensing chamber. If sufficient water enters the sensing chamber through the mechanical seal system, the probe shall sense the increase in conductivity and signal the solid state relay in the control panel. The relay shall then energize a warning light on the control panel, or optionally, cause the pump shut down. This system shall provide an early warning of mechanical seal leakage, thereby preventing damage to the submersible pump, and allowing scheduled rather than emergency maintenance. Systems utilizing float switches or any other monitoring devices located in the stator housing rather than in a sensing chamber between the mechanical seals are not considered to be early warning systems, and shall not be considered equal or acceptable.

As an option, an additional moisture sensing probe in the electrical connection chamber shall be available. This optional probe shall send a separate signal to the control panel as described above, so that maintenance personnel are given an early warning of the presence of moisture in the connection chamber.

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Shaft: The pump shaft and motor shaft shall be an integral, one piece unit adequately designed to meet the maximum torque required at any normal start—up condition or operating point in the system. The shaft shall have a full shutoff head design safety factor of 1.7, and the maximum shaft deflection shall not exceed .05 mm (.002 inch) at the lower seal during normal pump operation. Each shaft shall be stainless steel 1.4021 (AISI 420) material, and shall have a polished finish with accurately machined shoulders to accommodate bearings, seals and impeller. Carbon steel, chrome plated, or multi piece welded shafts shall not be considered adequate or equal.

Bearings: Each pump shaft shall rotate on high quality permanently lubricated, greased bearings. The upper bearing shall be a deep grooved ball bearing and the lower bearings shall be a heavy duty double row angular contact ball bearing. Bearings shall be of sufficient size and properly spaced to transfer all radial and axial loads to the pump housing and minimize shaft deflection. L—10 bearing life shall be a minimum of 100,000 hours at flows ranging from ½ of BEP flow to 1½ times BEP flow (BEP is best efficiency point). The bearings shall be manufactured by a major internationally known manufacturer of high quality bearings, and shall be stamped with the manufacturer's name and size designation on the race. Generic or unbranded bearings from other than major bearing manufacturers shall not be considered acceptable.

Power Cable: The power cables shall be sized according to NEC and CSA standards and shall be of sufficient length to reach the junction box without requiring splices. The outer jacket of the cable shall be oil and water resistant, and shall be capable of continuous submerged operation underwater to a depth of 65 feet.

Cable Entry/Junction Chamber: The cable entry design shall not require a specific torque to insure a watertight seal. The cable entry shall consist of cylindrical elastomer grommets, flanked by stainless steel washers. A cable cap incorporating a strain relief and bend radius limiter shall mount to the cable entry boss, compressing the grommet ID to the cable while the grommet OD seals against the bore of the cable entry. Cable entry designs which utilize potting compounds to provide a water tight seal, or those which do not allow the cable to be easily changed in the field shall not be considered equal.

The junction chamber shall be isolated and sealed from the motor by means of sealing glands. Electrical connections between the power cables and motor leads shall be made via a compression or post type terminal board, allowing for easy disconnection and maintenance.

## Control Panel Specifications

Furnish and install a Duplex Intrinsically—Safe Float control panel manufactured by EG Controls, Inc. represented by Flow—Technics, Inc. Frankfort, IL 815—277—2600.

The utility power supply at the pump station shall be 460 Volts, 3 Phase, 3—wire. The submersible pump motor shall be rated at 16.1 HP, 23.7 FLA's each and shall be equipped with an internal thermal switch for high—temperature protection and probes to detect the presence of moisture inside the motor housing.

The control system shall be designed to operate two submersible pumps based on wet well level monitored by float type level sensors. Four normally open float level sensors shall be required for automatic operation of the duplex pump station. The control panel shall be designed for the float level sensors to operate on 120 VAC and provide the following functions; stop pump, start lead pump, start lag pump and high water alarm. The panel shall require electromechanical and solid state components for interface with wet well level sensors, built—in pump sensors, and to meet control requirements.

## The control panel shall consist of but not be limited to the following:

NEMA 3R Galvanized Steel Enclosure w/ 12" leg stand kit Back panel and inner door Incoming power block Motor circuit breakers and control breaker

Control power circuit breaker Lightning Arrestor Elapsed Time Meters

1 KVA control transformer

Pump Run Pilot lights NEMA rated motor starters Control and alarm circuit fuses

H-O-A switches
Seal leak relays and pilot lights
Over-temp relays and pilot lights
Elapsed time meters

20A GFI receptacle and circuit breaker High water alarm light and flasher Dry contacts for alarm conditions

Space and labor to install telephone dialer

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Coordinate, install, and integrate into existing Building 37 Building Automation System (BAS) pump alarms

Accessories supplied for the pump station:

Qty 1 Stainless steel float bracket

Qty 4 Floats with 60' of cable

Qty 1 Anchor system with 20' of cable for floats Qty 2 Sections of 304 stainless steel guide pipe

Qty 1 ABS model EF04W—2A sump pump to be installed in the valve vault
Qty 1 Halliday Products model S2R 72" x 42" aluminum access hatch for the wet well

Qty 1 Halliday Products model S2R /2" x 42" aluminum access hatch for the wet well Qty 1 Halliday Products model S2R 30" x 48" aluminum access hatch for the valve vault

Qty 1 Halliady Products model S2R 30 x 48 aluminum access natch for the valve value Qty 2 ABS 'Sealminder" relays to be installed in the control panel for seal leak detection

Qty 2 25' sections of stainless steel lifting chain for the pumps

# <u>Miscellaneous</u>

Manufacturer shall supply "As—Built" drawings for control panel. Final drawings showing any revisions to controls shall be provided following manufacturers start—up services if changes are made in the field.

Contractor Shall Provide Four Copies of Operations and Maintenance Manuals for Use By VA Staff.

Contractor Shall Coordinate and Provide Two Training Sessions for VA Staff in Operations and Maintenance of Lift Station.

All panels shall be tested to the power requirements as shown on the plans to assure proper operation of all components. Each control function shall be activated to check for proper indication prior to shipment of control panel.

Contractor shall have experience in municipal lift station construction, and shall construct and provide system to function in its intended

manner.

All equipment shall be guaranteed for a period of one [1] years from date of installation. The guarantee is effective against all defe

All equipment shall be guaranteed for a period of one [1] years from date of installation. The guarantee is effective against all defects in workmanship and/or defective components. The warranty is limited to replacement or repair of the defective equipment.

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